**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

| | | | |
|---|---|---|---|
| In re application of: | Cantor et al. | Confirmation No.: | 6905 |
| Application No.: | 10/655,762 | Group No.: | 1637 |
| Filed: | September 5, 2003 | Examiner: KIM, YOUNG J | |

For: QUANTIFICATION OF GENE EXPRESSION

**DECLARATION OF DR. CHARLES CANTOR**

I, Charles Cantor, Ph.D., declare as follows:

1. I am a co-inventor in the above-identified patent application.

2. I have served as chair and professor of the department of biomedical engineering and biophysics, and Director of the Center for Advanced Biotechnology at Boston University since 1992. Prior to that time, I held positions at Columbia University and the University of California, Berkeley. I have also been the Director of the Human Genome Center Project of the Department of Energy at Lawrence Berkeley Laboratory. In 1998, I joined Sequenom, Inc. as a Chief Scientific Officer and Chairman of the Scientific Advisory Board. In May 2000, I was appointed to the Company's board of directors. I am a consultant to more than 16 biotech firms, and I have published more than 400 peer reviewed articles. I have been granted over 50 US patents, and I have co-authored a three-volume textbook on Biophysical Chemistry. I published the first textbook on genomics entitled, Genomics: The Science and Technology of the Human Genome Project. Accordingly, I have significant experience and expertise in use and development of methods used for nucleic acid analysis, including nucleic acid quantification.

3. A true copy of my current *curriculum vitae* is attached herewith.

4. I have been advised that the Examiner has cited the following three articles in connection with the examination of the above-identified patent application: Becker-André and Hahlbrock, Nucleic Acid Research 17 (22): 9437-9446, 1998 ("Becker"), Amexis et al., Proc. Natl. Acad. Sci. U.S.A. 98 (21): 12097-12102, 2001 ("Amexis") and Ross et al, Biotechniques, 29 (3): 620-629, 2000 ("Ross").

5. I have been advised also that the Examiner has argued that "The absolute quantitation is based on the comparing the amount of signal determined from the target nucleic acid against the amount of signal determined from known varying amounts of standard nucleic acids (i.e., standard curve) [Becker] and since the MALDL-TOF assay produced consistent and reliable quantitation of signals, one of ordinary skill in the art at the time the invention was made *would have had a reasonable expectation of success at combining the teachings* of the references, thereby arriving at the invention as claimed." See May 11, 2009 Office Action, page 9, paragraph 2 of; emphasis added.

6. I disagree with the Examiner's assertions for the reasons explained in detail below.

7. Becker quantified a nucleic acid using a standard that differed by one nucleotide from the target so that a restriction enzyme would digest one of the amplified nucleic acids.

8. Although Becker discussed the possibility of absolute quantification, Becker required an *extra step of diluting* the PCR reaction mixture prior to the last PCR cycle in the amplification step in order to be quantitative and determine an absolute amount of the target nucleic acid.

9. Becker especially emphasized the importance of this diluting step for the purpose of comparing the amount of signal determined from the target nucleic acid against the amount of signal determined from the standard nucleic acids, as cited:

> "Using a mixture of authentic (endogenous = en) and mutated (exogenous = ex) *in vitro* $RNA^{4CL}$ transcripts we could show that the ratio of signal intensities of the detected bands represented the ratio of RNA amounts present in the beginning. However, *it was crucial to dilute the sample before the last PCR cycle. Otherwise, the upper band (en) was consistently over-represented.*" See Becker, page 9440, paragraph 2, lines 1-6; emphasis added.

Moreover, Becker also described that this **dilution step is necessary for absolute quantification** of nucleic acid in order to avoid the problem of "heterodimeric DNA" phenomenon after certain cycle numbers of PCR amplification. See Becker, e.g., page 9440, paragraph 2, lines 7-12; page 9443, paragraph 2, lines 1-5. Therefore, without the dilution step, the result of quantification in Becker would not have been accurate, and the quantification of an absolute amount of target would have been greatly compromised.

10. In contrast, we have explicitly addressed in the specification that the absolute quantification method of the claimed invention needs virtually no optimization for PCR

amplification. Hence we do not need the dilution step in any of the PCR cycles. Our absolute quantification method is also independent of PCR cycle numbers.

11. Also, the heterodimeric DNA problem means that the accuracy of each assay will be different and accounting for this difference requires a correction factor that will be different for each assay (every target). Our method does not have to make adjustments specific to each target. Therefore, for the reasons provided above, Becker does not teach or suggest a method that would be useful as an absolute quantification method and/or allow at least two or more targets to be analyzed simultaneously.

12. It is my opinion, that if it had been obvious to use Becker to design an absolute quantification method using mass spectrometry, which has been generally known as an analysis tool since at least the mid 1980's with commercial instruments introduced in the early 1990s, it would not have taken over 10 years from the publication of Becker to develop such a method.

13. Neither Amexis nor Ross even mention that their methods can be applied for absolute quantification.

14. I am intimately aware of what is described in Amexis as I am one of the co-authors of the article. Amexis quantified the **relative levels** of two virus variants in one reaction through PCR and MassArray system. See Amexis, e.g., page 12100, first column, last paragraph. Comparing the **relative amount** of allelic variants does not allow absolute quantification of nucleic acid species in the reaction. Additionally, because Amexis evaluated relative amounts of allelic products already in the sample, Amexis did not add an external standard.

15. Ross also quantified the *relative levels* of pooled allelic variants and therefore, for the same reason as Amexis, does not describe how absolute quantification could be achieved. See Ross, e.g., page 624, first column, paragraphs 1 and 2. Also Ross did not use an external standard.

16. Both Amexis and Ross compared the relative amount of allelic variants; therefore, targets analyzed by the methods described by Amexis and Ross are limited to those targets that comprise an allele (e.g., polymorphism). In contrast, the methods we describe are polymorphism-independent, thus allowing for the absolute quantification of a wider range of targets (e.g., gene sequences that do not contain a polymorphism).

17. It is well known and also stated in Ross that single base extension, like the one used in the presently claimed methods, produces mass differences between 9 and 40 Da.

18. However, Ross specifically states that "baseline resolution between alleles differing by 16 Daltons (Da) or less may not be observed" (p. 622, 1st col.).

19. Ross also states that "area measurement of a low-intensity extension produces within 40 Da of another allele may be confounded by trace cation...adducts onto the lower mass allele" (p. 622, 1st col.).

20. Therefore, Ross teaches that they made sure that all primer extensions resulted in mass differences between 300-400 Da. Page 622, 1st col.). Ross specifically taught that "two related strategies were selected by which a molecular weight separation of about *300-400 Da* between allele products of a given locus could be achieved during the primer extension assay." See Ross, page 622, paragraph 3, lines 1-6. Ross expected a clear separation of 300-400 Da between alleles and extension products for reliable peak detection and reliable quantification of nucleic acids. One strategy of Ross terminated the variants of the nucleic acid by one (wild-type) and two (mutant) bases, thus enhanced the mass difference; and the other strategy terminated the variants of the nucleic acid by one base (wild-type) and a fluorescently labeled base (mutant). Neither one of the modified primer extension strategies of Ross, is the same as the single-base primer extension method of the present invention.

21. Single base extension like the one we used, does not produce mass differences of 300-400 Da.

22. Therefore, **Ross teaches against or away** from the method we found to be most effective for absolute quantification purposes.

23. In view of the above, it is my opinion that one of ordinary skill in the art would not have expected that combination of the mutation analysis of Becker with MALDO-TOF analysis **using a single base extension** could be used to provide accurate quantitative measurements of the **absolute amount** of nucleic acids in a sample.

24. Even if one were to combine the references, one would be expected to use dilution of PCR mixture before last PCR cycle to obtain a sample that might allow absolute quantification and **one would have not used a single base extension** but an extension reaction that would have

resulted in differences between 300-400 Da in molecular weight of the control and the allele one wishes to quantify.

25. Moreover, one would have been skeptical about quantifying after the dilution step because it could have been considered to lead to a very low amount of sample that would have lowered the peak intensity, sacrificed the signal to noise level and returned an unreliable quantification result when using MALDI-TOF. Therefore, based on this, it is my opinion that one would not have expected the combination of Becker with Ross and/or Amexis to work.

26. In contrast, as already presented in the previous response, we surprisingly discovered that we can accurately **quantify the absolute amount** of multiple target sequences with multiple internal standards in the same reaction (e.g., triplex targets). We found that the extension products were clearly separated in the mass spectrum with very strong signal to noise level. In particular, the mass differences between several extension products were very small. For example, mass difference between glut3-S and glut3-A was only about 20-25 Da, yet, contrary to what Ross described, we found that the two peaks were clearly separated with strong peak intensities. See September 10, 2007 Response, page 6, last paragraph to page 7, paragraph 2 and Exhibit A. These absolute quantification results by multiplex reactions agreed well with those from uniplex reactions. Moreover, we found that the same method can be used to quantify at least about 20 targets in one multiplex reaction.

27. In summary, at the time of the invention, *absolute quantification* of multiple nucleic acids using mass spectrometric detection and single base extension reactions in the same reaction was not something scientists performed or would have expected to succeed. One skilled in the art would not have been motivated to use internal standards with multiplex target nucleic acids for absolute quantification of multiplex without diluting the amplified mixtures, and one would not have been motivated to subsequently use mass spectrometric analysis combined with single-base primer extension for absolute quantification of multiple nucleic acids in the same reaction, particularly when the multiple nucleic acids differentiating only by *small mass differences*.

28. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information are believed to be true, and further that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, and that such willful false statements may jeopardize the validity of the application or any patent that issues therefrom.

2/16/10

Date

Charles Cantor

# Charles R. Cantor

## Curriculum Vitae

Born: August 26, 1942; Brooklyn, New York

## Education

| | |
|---|---|
| 1963 | A.B., Columbia University, *Summa Cum Laude* |
| 1966 | Ph.D., University of California, Berkeley<br>Eastman Kodak Award<br>Research Sponsor: Prof. I. Tinoco, Jr. |

## Employment

| | |
|---|---|
| 1966-1969 | Assistant Professor of Chemistry, Columbia University |
| 1969-1972 | Associate Professor of Chemistry, joint appointment in Biological Sciences, Columbia University |
| 1972-1981 | Professor of Chemistry, joint appointment in Biological Sciences, Columbia University |
| 1981-1989 | Professor and Chairman of Genetics and Development, College of Physicians and Surgeons, Columbia University; and Deputy Director for Education, 1981-85, Comprehensive Cancer Center; Deputy Director for Biotechnology, 1985-88, Comprehensive Cancer Center |
| 1988-1989 | Higgins Professor of Genetics and Development, Faculty of Medicine, Columbia University |
| 1988-1990 | Director, Human Genome Center, Lawrence Berkeley Laboratory |
| 1989-1991 | Senior Biochemist, Cell and Molecular Biology Division, Lawrence Berkeley Laboratory |
| 1989-1992 | Professor of Molecular Biology, University of California, Berkeley |
| 1990-1992 | Principal Scientist, Human Genome Project, U.S. Department of Energy |
| 1991-1992 | Senior Biochemist, Chemical Biodynamics Division, Lawrence Berkeley Laboratory |
| 1992-present | Professor of Biomedical Engineering and Biophysics, Boston University |
| 1992-present | Director, Center for Advanced Biotechnology, Boston University |
| 1994-present | Professor, Pharmacology Department, Boston University Medical School |
| 1995-1998 | Chair, Department of Biomedical Engineering, Boston University |
| 1998-present | Chief Scientific Officer, Sequenom, Inc. and Member, Board of Directors |
| 2001-present | Adjunct Professor, Department of Bioengineering, UCSD |

## Awards and Honors

| | |
|---|---|
| 1969-1971 | Fellow of the Alfred P. Sloan Foundation |
| 1972 | Fresenius Award in Chemistry |
| 1973-1974 | Guggenheim Fellow |
| 1975-1976 | Fairchild Distinguished Visiting Scholar, California Institute of Technology |
| 1978 | Eli Lilly Award in Biological Chemistry |
| 1981 | Fellow of the American Association for the Advancement of Science |

| | |
|---|---|
| 1985 | Outstanding Investigator Grant, National Cancer Institute |
| 1988 | Biochemical Analysis Prize of the German Society of Clinical Chemistry |
| 1988 | Member of the National Academy of Sciences |
| 1988 | Member of the American Academy of Arts and Sciences |
| 1989 | ISCO Award for Advances in Biochemical Instrumentation |
| 1990 | Herbert A. Sober Award, American Society for Biochemistry and Molecular Biology |
| 1990 | Honorary Member, Japanese Biochemical Society |
| 1992 | Fellow of the California Academy of Sciences |
| 2000 | Fellow of the Biophysical Society |
| 2000 | Emily M. Gray Award, Biophysical Society |
| 2002 | Chief Scientist of the Year, T Sector and BIOCOM |
| 2004 | The Ohio State University Human Cancer Genetics Program Commemorative Medal for Excellence in Research and Clinical Care |
| 2006 | Fellow of the American Institute for Medical and Biological Engineering |

## Special Lectureships

| | |
|---|---|
| 1985 | Distinguished Lecturer, University of Tennessee |
| 1985 | Distinguished Lecturer, University of Cincinnati |
| 1985 | Jesse Beams Lecturer, University of Virginia |
| 1986 | Barton Lecturer, University of Oklahoma |
| 1986 | Peter Debye Lecturer, Cornell University |
| 1986 | Stephanie Lynn Kossoff Memorial Lecturer, Columbia University |
| 1987 | Reilly Lecturer, Notre Dame University |
| 1987 | Allied Corporation Lecturer, Waksman Institute |
| 1987 | Visiting Scholar, Japan Society for the Promotion of Science |
| 1988 | Veatch Lecturer, Harvard Medical School |
| 1988 | Sol Spiegelman Lecturer, University of Illinois |
| 1989 | Steinberg/Wylie Lecturer, University of Maryland |
| 1989 | Biochemical Society Lecturer, British Association for the Advancement of Science |
| 1989 | Ronald R. Fisher Lecturer, University of South Carolina |
| 1990 | Boyce Thompson Distinguished Lecturer, Cornell University |
| 1990 | Distinguished Lecturer, Oak Ridge National Laboratory |
| 1991 | Hanna Memorial Lecturer, Case Western Reserve University |
| 1991 | Distinguished Speaker in Biochemistry and Molecular Biology, University of Wisconsin, Milwaukee |
| 1992 | Baker Lecturer, Cornell University |
| 1992 | Special Chair Professor, National Science Council, Republic of China |
| 1994 | Barnett Lecture in Bioanalytical Chemistry, Northeastern University |
| 1996 | Douglas G. Hill Memorial Lecturer, Duke University |
| 1997 | University Lecturer, Boston University |
| 1998 | Distinguished Lecturer, George Mason University |
| 1998 | George Burch Memorial Lecture, Association of University Cardiologists |
| 2001 | Plenary Lecture, Biophysical Society of Taiwan Seventh Annual Symposium on Recent Advances in Biophysics |
| 2002 | Harvard University Morrison Lecture |
| 2004 | McElvan Lecturer, University of Wisconsin, Madison on Analytical Chemistry |
| 2005 | Rachford Lecturer, Children's Hospital of Cincinnati |

| | |
|---|---|
| 2006 | Honorary Faculty Member, Fourth Military Academy Medical University, Xi'an, China |
| 2008 | Distinguished Lecturer, Center for Prostate Disease Research (DPDR), Rockville, MD |

## Professional Affiliations and Service

| | |
|---|---|
| 1971-1975 | NIH Study Section, BBCA |
| 1972-1986 | Editorial Board, *Archives of Biochemistry and Biophysics* |
| 1972-1981 | Editorial Board, *Journal of Molecular Evolution* |
| 1972-1992 | Editorial Board, *Journal of Molecular Biology* |
| 1973-1986 | Editorial Advisory Board, *Biopolymers;* Editorial Board, 1980-83 |
| 1973-1988 | Editorial Board, *Nucleic Acids Research* |
| 1974 | Co-chairman, Biopolymers Gordon Conference |
| 1974-1992 | Harvey Society |
| 1976-1988 | Proposal Review Panel, Stanford Synchrotron Radiation Laboratory; Chairman, 1980-88 |
| 1976-present | Series Editor, *Advanced Textbooks in Chemistry*, Springer-Verlag, New York |
| 1977-1981 | CMBD Review Committee, NIGMS, NIH; Chairman, 1979-81 |
| 1978-1983 | Editorial Board, *Biochemistry* |
| 1978-1983 | Board of Trustees, Cold Spring Harbor Laboratory |
| 1978-present | Biophysical Society; Council Member, 1978-81 |
| 1979-1981 | Nominating Committee, American Chemical Society, Division of Biological Chemistry |
| 1980-1994 | Society for Analytical Cytology |
| 1981-1986 | Editorial Board, *Journal of Biological Chemistry* |
| 1982-present | American Society of Biochemistry and Molecular Biology, formerly American Society of Biological Chemists; Nominating Committee, 1982-83 |
| 1982-1994 | Associate Editor, *Annual Review of Biophysics and Biophysical Chemistry* |
| 1983-1984 | National Research Council Committee on Causes and Effects of Changes in Stratospheric Ozone |
| 1983-1987 | Consultant, Syntex Medical Diagnostics |
| 1983-1987 | Associate Editor, *Journal of Molecular Evolution* |
| 1984-1985 | Consultant, Lifecodes, Inc., formerly Actagen, Inc. |
| 1984-1988 | Editorial Board, *Accounts of Chemical Research* |
| 1984-1988 | Consultant, LKB-Produkter AB |
| 1984-1989 | Principal Investigator, Columbia University, Member of MacArthur Foundation Consortium on the Biology of Parasitic Diseases |
| 1984-1995 | Advisory Council, Department of Molecular Biology, Princeton University |
| 1984-1986 | Scientific Advisory Board, American Cyanamid Company, Wayne, NJ |
| 1984-present | Nomenclature Commission of the International Union of Biochemistry and Molecular Biology |
| 1985-1986 | Office of Technology Assessment Advisory Panel on Determining Mutation Frequencies in Human Beings |
| 1985-1986 | Consultant, Molecular Biophysics Technology, Inc. |
| 1985-1989 | National Research Council Committee on Research Opportunities in Biology |
| 1985-1991 | Board of Reviewing Editors, *Science* |
| 1985-present | Consultant, Genelabs, Inc., Redwood City, CA |
| 1985-1994 | U.S. National Committee of International Union of Pure and Applied Biophysics; Vice Chairman, 1988-1990; Chairman, 1991-1994 |

| | |
|---|---|
| 1986 | Chairman, Committee for External Review, Department of Genetics, Stanford University |
| 1986-1987 | Department of Energy HERAC Subcommittee on the Human Genome |
| 1986-1988 | National Research Council Committee on the Human Genome |
| 1986-1989 | Council, National Institute of General Medical Sciences, NIH |
| 1986-1989 | Visiting Committee for Brookhaven National Laboratory Biology Department |
| 1987-1989 | Scientific Advisory Board, Hereditary Disease Foundation |
| 1987-1994 | Subject Area Editor, *Genomics* |
| 1987-1994 | Advisory Committee, Searle Scholars Program; Chairman, 1993-1994 |
| 1987-2000 | Scientific and Technical Advisory Board, Prince Ventures Partner, III |
| 1988-1991 | Co-organizer, Three Cold Spring Harbor Laboratory Meetings on Genome Mapping and Sequencing |
| 1988-1996 | Scientific Advisory Council, Roswell Park Memorial Institute |
| 1988-2004 | Biomedical Advisory Committee, Pittsburgh Supercomputing Center |
| 1988-present | Cell and Membrane Transport Commission, International Union of Pure and Applied Biophysics |
| 1988-1992 | Chairman, Department of Energy Human Genome Coordinating Committee; member, 1991-1994 |
| 1988-present | Member, Executive Committee and Founding Council, International Human Genome Organization [HUGO]; Vice President, 1990-present; Chairman, 1991-1995; Chair, HUGO Human Genome Mapping Committee [HGMC]; President, HUGO Americas, 1992-1997 |
| 1988-present | Editorial Board, *Current Opinion in Biotechnology* |
| 1988-1998 | Consultant, Amersham-Pharmacia Biotechnology, formerly Pharmacia LKB Biotechnology AB |
| 1989-1990 | Member, NAS/NRC Panel on Cooperation with the USSR on Structure of the Eucaryotic Genome and Regulation of its Expression |
| 1989-1991 | Member, Executive Committee, Human Gene Mapping Workshops |
| 1989-present | American Society of Human Genetics |
| 1989-1992 | Co-chair, Human Genome I, II, III meetings |
| 1989-1994 | Scientific Advisory Committee, European Molecular Biology Laboratory |
| 1989-2004 | Advisory Committee, University of Pittsburgh Biotechnology Center |
| 1990-1993 | Advisory Committee, MacArthur Foundation Program in Parasite Biology |
| 1990-1995 | Member, Board of Scientific Counselors, National Center for Biotechnology Information [NCBI], National Library of Medicine |
| 1990-1998 | Member, UNESCO Scientific Coordinating Committee on the Human Genome Project |
| 1991-1993 | Member, Scientific Advisory Board, Ribogene, Inc. |
| 1991-2002 | Member, Advisory Board, Encyclopedia of Molecular Biology and Biotechnology |
| 1992-1997 | Member, Board of Directors, Chair, Scientific Advisory Board, ATGC/AT Biochem, Inc. |
| 1992-2002 | Member, Scientific Advisory Board, Aclara, Inc., formerly Soane Technologies, Inc., Hayword, CA |
| 1992-1994 | Organizer, 1st through 3rd International Conference on Bioinformatics, Supercomputing, and Complex Genome Analysis, Tallahassee, FL |
| 1993-2000 | Member, Board of Scientific Advisors, Mosaic Technologies, Inc., Boston, MA |
| 1993-1998 | Member, Plant Genome Science and Technology Coordinating Committee, Department of Agriculture |
| 1993-1994 | Chair, European Bioinformatics Institute [EBI] Advisory Committee |
| 1993-1998 | Member, Scientific Advisory Committee, Incyte Pharmaceuticals, Inc., Palo Alto, CA |

| | |
|---|---|
| 1994-present | Member, Advisory Board, Boston University *Journal of Science Technology and Law* |
| 1994-1998 | Consultant, SEQUENOM, Inc., San Diego, CA |
| 1994-2007 | Co-chair, Biotechnology Advisory Committee, Fisher Scientific, Hampton, NH |
| 1994-1998 | Member, HERAC Genome Project Subcommittee |
| 1995-1998 | Consultant, Trichor, Boston, MA |
| 1996-1997 | Member, NRC Committee, "Bits of Power" |
| 1996-2000 | Consultant, AmberGen, Boston, MA |
| 1996-2002 | Member, Advisory Committee, ELBA Foundation, Italy |
| 1997-2000 | Member, DARPA Advisory Committee on Biological Warfare Defense |
| 1997-1998 | Treasurer, New England Complex Systems Institute |
| 1996-2000 | FASEB Consensus Committee on Federal Funding, representing the Biophysical Society; Chair, DOE Subcommittee |
| 1997-present | Advisor, Techno Ventures Management, Munich |
| 1996-2002 | Consultant, Caliper, Inc., Palo Alto, CA |
| 1997-2000 | Member, The Protein Society |
| 1997-1999 | Quest Scholar, Quest Diagnostics, Inc., San Juan Capistrano, CA |
| 1998-present | Member, Defense Intelligence Agency Bio 2020 Red Team, Washington, D.C. |
| 1999-present | Science Board, GENpathways, formerly CIStem, San Diego, CA |
| 2000-2005 | Consultant, Samsung SAIT, Korea |
| 2000-present | Board of Directors, Human BioMolecular Research Institute, San Diego, CA |
| 2000-2001 | Editorial Advisory Board, Oxford University Press |
| 2001-2009 | Editorial Board, *Proceedings of the National Academy of Sciences* |
| 2001-present | Editorial Board, *American Journal of PharmacoGenomics* |
| 2001-present | Editorial Advisory Board, *Genomics and Proteomics* |
| 2001-2007 | Member, Lawrence Livermore National Laboratories BBRP Board |
| 2001-present | Dean's Advisory Board, Division of Biology, University of California San Diego |
| 2001-present | Industrial Advisory Board, Department of Chemistry and Biochemistry, University of California San Diego |
| 2001-present | Member, Board of Overseers, Brandeis University School of Science |
| 2001-2008 | Scientific Advisor, Automated Cell, Pittsburgh, PA |
| 2001-present | Scientific Advisory Board, Cellicon, Boston, MA |
| 2001-2003 | Scientific Advisory Board, GeneFormatics, Inc., San Diego, CA |
| 2001-2005 | Scientific Advisory Board, Odyssey, Inc., San Ramon, CA |
| 2001–present | Board of Directors, EXSAR, formerly know as Carta Proteomics, Monmouth Junction, NJ |
| 2002-present | Editorial Team, *Drug Discovery Today* |
| 2002-2004 | Board of Directors, SIGA Technologies, Inc., San Diego, CA |
| 2002-2004 | Board of Directors, Plexus Vaccine, San Diego, CA |
| 2002-present | Advisory Committee Member, Stockholm Strategic Research Foundation |
| 2002-2008 | Board of Directors, Molecular Sciences Institute, Berkeley, CA |
| 2002-2007 | Scientific Advisory Board, Rodi Pharmaceuticals, Del Mar, CA |
| 2002-2007 | Scientific Advisory Board, Buffalo Center of Excellence in Bioinformatics |
| 2002-present | Founder and Member, Board of Directors, 2002-03, SelectX Pharmaceuticals, Inc., Worcester, MA |
| 2003-present | Scientific Advisory Board, Strand Genomics, Bangalore, India |
| 2003-present | Member, Editorial Academy, *International Journal of Oncology*, Athens, Greece |

| | |
|---|---|
| 2003-present | Member, National Advisory Board, Boston University Research Center for Translational Genomics and Human Rights, Boston, MA |
| 2004–present | Scientific Advisory Board, GeneGo, St. Joseph, MI |
| 2004–present | Scientific Advisory Board, Modular Genetics, Woburn, MA |
| 2004–present | Scientific Advisory Board, NuAce Technologies, Ramat-Hasharon Israel |
| 2004–present | Scientific Advisory Board, Provid Research, Piscataway, NJ |
| 2004–present | Scientific Advisory Board, StructureSpec, La Jolla, CA |
| 2004-2006 | Scientific Advisory Board, Joint Center for Structural Genomics (JCSG), La Jolla, CA |
| 2004-2007 | Scientific Advisory Board, UppsalaBio-X, Uppsala, Sweden |
| 2005-present | Member, Board of Directors, Silicon Kinetics, San Diego, CA |
| 2005-2006 | Member, The National Academies Committee on Review of Department of Energy's Genomics: GTL Program, Washington, DC |
| 2006-present | Member, National Academy of Sciences, Research at the Intersection of the Physical and Life Sciences (RIPLS), Washington, DC |
| 2006-present | Member, Scientific Advisory Board, Cyntellect, Inc., San Diego, CA |
| 2007-present | Founder, CEO, Board of Directors, DiThera, Inc. |
| 2007-present | Founder, Chairman, Board of Directors, Retrotope, Inc., Los Altos, CA |
| 2008-present | Member, Scientific Advisory Board, Applied Vaccine Therapeutics (AVT), White Plains, NY |
| 2008-present | Member, Moscow Rosnano Tech Advisory Board, Moscow, Russia |
| 2009-present | Chair, Scientific Advisory Board, Immunolite, Durham, NC |

## Publications

- Over 450 Journal Articles
- Cantor, C. R., and Schimmel, P. R. *Biophysical Chemistry*. San Francisco: W.H. Freeman and Company, 1980. 3 Volumes.
- Cantor, C.R., and Smith C.L. *Genomics: The Science and Technology of the Human Genome Project*, Wiley, Interscience, 1999.

## Patents

Cantor, C.R. and Schwartz, D.C.: *Electrophoresis Using Alternating Transverse Electric Fields*, Norway Euro Patent No. NO 0172156 C, granted 05/24/84

Cantor, C.R. and Schwartz, D.C.: *Electrophoresis Using Alternating Transverse Electric Fields*, Japanese Patent No. JP 3052907 B4, granted 05/24/84

Cantor, C.R. and Schwartz, D.C.: *Electrophoresis Using Alternating Transverse Electric Fields*, US Patent No. US 4,473,452, granted 09/25/84

Cantor, C.R. and Schwartz, D.C.: *Electrophoresis Using Alternating Transverse Electric Fields*, Canadian Patent No. CA 1,207,275, granted 07/08/86

Cantor, C.R., Axel, R., and Argarana, C.: *DNA Encoding Streptavidin, Streptavidin Produced Therefrom, Fused Polypeptides which Include Amino Acid Sequences Present in Streptavidin and Uses Thereof*, European Patent No. EP 0258411, granted 08/27/87

Cantor, C.R., Axel, R., and Argarana, C.: *DNA Encoding Streptavidin, Streptavidin Produced Therefrom, Fused Polypeptides which Include Amino Acid Sequences Present in Streptavidin and Uses Thereof*, Japanese Patent No. JP 63502560, granted 08/27/87

Cantor, C.R., Axel, R., and Argarana, C.: *DNA Encoding Streptavidin, Streptavidin Produced Therefrom, Fused Polypeptides which Include Amino Acid Sequences Present in Streptavidin and Uses Thereof,* Australian Patent No. AU 7165287, granted 08/27/87

Saffran, W.A., Edelson, R.L., Gasparro, F.P., Welsh, J., and Cantor, C.R.: *Biotinylated Psoralens,* European Patent No. EP 0266212, granted 10/08/87

Saffran, W.A., Edelson, R.L., Gasparro, F.P., Welsh, J., and Cantor, C.R.: *Biotinylated Psoralens,* Australia Patent No. AU 7237287 A1, granted 10/08/87

Cantor, C.R. and Schwartz, D.C.: *Gel Inserts Useful in Electrophoresis,* US Patent No. US 4,695,548, granted 09/22/87

Collins, F., Weissman, S., and Cantor, C.R.: *Coincidence Cloning Method and Library,* Australia Patent No. AU 2318288 A1, granted 02/23/89

Cantor, C.R., Axel, R., and Argarana, C.: *DNA Encoding Streptavidin, Streptavidin Produced Therefrom, Fused Polypeptides which Include Amino Acid Sequences Present in Streptavidin and Uses Thereof,* US Patent No. US 4,839,293, granted 06/13/89

Cantor, C.R. and Schwartz, D.C.: *Electrophoretic Methods Employing Gel Inserts,* US Patent No. US 4,861,448, granted 08/29/89

Saffran, W.A., Edelson, R.L., Gasparro, F.P., Welsh, J.T., and Cantor, C.R.: *Biotinylated Psoralens,* US Patent No. US 4,868,311, granted 09/19/89

Van der Ploeg, L.H.T., Giannini, S.H., and Cantor, C.R.: *Method for Detecting Animal-Infective Protozoa* in vitro *and a Method for Detecting Agents which Block the Differentiation Thereof,* US Patent No. US 4,908,308, granted 03/13/90

Cantor, C.R., Köster, H., Smith, C.L., and Fu, D.J.: *Solid Phase Sequencing of Biopolymers,* European Patent No. EP 0830460, granted 11/06/92

Cantor, C.R. and Schwartz, D.C.: *Electrophoresis Using Alternating Transverse Electric Fields,* European Patent No. EP 0125310, granted 02/10/93

Cantor, C.R. and Schwartz, D.C.: *Electrophoresis Using Alternating Transverse Electric Fields,* Austria Euro Patent No. AT 0040752E, granted 02/10/93

Cantor, C.R. and Schwartz, D.C.: *Electrophoresis Using Alternating Transverse Electric Fields,* Australia Patent No. AU 565758, granted 02/10/93

Cantor, C.R. and Schwartz, D.C.: *Electrophoresis Using Alternating Transverse Electric Fields,* German Euro Patent No. DE 3379177 C0, granted 02/10/93

Cantor, C.R. and Schwartz, D.C.: *Electrophoresis Using Alternating Transverse Electric Fields,* Denmark Euro Patent No. DK 0169978 B1, granted 02/10/93

Cantor, C.R. and Schwartz, D.C.: *Electrophoresis Using Alternating Transverse Electric Fields,* Finland Euro Patent No. FI 0084518C, granted 02/10/93

Cantor, C.R., Chuck, R.S., and Tse, D.B.: *Design and Synthesis of Bisecific DNA-antibody Conjugates,* US Patent No. US 5,635,602, granted 08/13/93

Edwards, C.A., Cantor, C.R., and Andrews, B.M.: *Screening Assay for the Detection of DNA-Binding Molecules,* US Patent No. US 5,306,619, granted 04/26/94

Edwards, C.A., Cantor, C.R., Andrew, B.M., Turin, L.M., and Fry, K.E.: *Sequence-Directed DNA-Binding Molecules Compositions and Methods,* European Patent No. EP 0684999, granted 07/07/94

Edwards, C.A., Cantor, C.R., Andrews, B.M., Turin, L.M., and Fry, K.E.: *Sequence-Directed DNA-Binding Molecules Compositions and Methods,* Canadian Patent No. CA 2,152,501 A1, granted 07/07/94

Edwards, C.A., Cantor, C.R., Andrews, B.M., Turin, L.M., and Fry, K.E.: *Sequence-Directed DNA-Binding Molecules Compositions and Methods,* Australian Patent No. AU 685085, granted 07/07/94

Sano, T. and Cantor, C.R.: *Recombinant Streptavidin-Protein Chimeras Useful for Conjugation of Molecules in the Immune System,* US Patent No. US 5,328,985, granted 07/12/94

Cantor, C.R., Niemeyer, C.M., Smith, C.L., Sano, T., Hnatowich, D.J., and Rusckowski, M.: *Self-Assembling Multimeric Nucleic Acid Constructs,* European Patent No. EP 0744894, granted 08/03/95

Cantor, C.R., Niemeyer, C.M., Smith, C.L., Sano, T., Hnatowich, D.J., and Rusckowski, M.: *Self-Assembling Multimeric Nucleic Acid Constructs,* Japanese Patent No. JP 9511641, granted 08/03/95

Cantor, C.R., Niemeyer, C.M., Smith, C.L., Sano, T., Hnatowich, D.J., and Rusckowski, M.: *Self-Assembling Multimeric Nucleic Acid Constructs,* Australia Patent No. AU 1730595 A1, granted 08/03/95

Cantor, C.R., Ito, T., and Smith, C.L.: *DNA Purification by Triplex-Affinity Capture and Affinity Capture Electrophoresis,* US Patent No. US 5,482,836, granted 01/09/96

Cantor, C.R.: *Positional Sequencing by Hybridization,* US Patent No. US 5,503,980, granted 04/02/96

Edwards, C.A., Cantor, C.R., and Andrews, B.M.: *Screening Assay for the Detection of DNA-Binding Molecules,* Canadian Patent No. CA 2,112,130, granted 08/06/96

Cantor, C.R., Niemeyer, C.M., Smith, C.L., Sano, T., Hnatowich, D.J., and Rusckowski, M.: *Self-Assembling Multimeric Nucleic Acid Constructs,* US Patent No. US 5,561,043, granted 10/01/96

Szafranski, P., Mello, C.M., Sano, T., Marx, K.A., Cantor, C.R., Kaplan, D.L., and Smith, C.L.: *Biotin-Binding Containment Systems,* Australia Patent No. AU 5443896 A1, granted 11/07/96

Cantor, C.R., Köster, H., Smith, C.L., and Fu, D.J.: *Solid Phase Sequencing of Biopolymers,* European Patent No. EP 0830469 A1, granted 11/17/96

Cantor, C.R., Köster, H., Smith, C.L., and Fu, D.J.: *Solid Phase Sequencing of Biopolymers,* Canadian Patent No. CA 2218188, granted 11/17/96

Cantor, C.R., Köster, H., Smith, C.L., and Fu, D.J.: *Solid Phase Sequencing of Biopolymers,* Japenese Patent No. JP 11503611T, granted 11/17/96

Smith, C. L., Yaar, R., Szafranski, P., and Cantor, C. R.: *Nucleic Acid Detection Methods,* Australia Patent No. AU 6248696 A1, granted 11/21/96

Smith, C. L., Yaar, R., Szafranski, P., and Cantor, C. R.: *Nucleic Acid Detection Methods,* Canadian Patent No. CA 2,221,467 A1, granted 11/21/96

Edwards, C.A., Cantor, C.R., Andrews, B.M., Turin, L.M., and Fry, K.E.: *Sequence-Directed DNA-Binding Molecules Compositions and Methods,* US Patent No. US 5,578,444, granted 11/26/96

Sano, T., Cantor, C.R., Vajda, S., Reznik, G.O., Smith, C.L., and Pandori, M.W.: *Streptavidin Mutants*, Australia Patent No. AU 5917796, granted 03/27/97

Sano, T., Cantor, C.R., Vajda, S., Reznik, G.O., Smith, C.L., and Pandori, M.W.: *Streptavidin Mutants*, European Patent No. EP 0856055 A1, granted 03/27/97

Sano, T., Cantor, C.R., Vajda, S., Reznik, G.O., Smith, C.L., and Pandori, M.W.: *Streptavidin Mutants*, Canadian Patent No. CA 2,222,035 A1, granted 03/27/97

Smith, C.L., Pandori, M.W., Sano, T., Vajda, S., Cantor, C.R., and Reznik, G.O.: *Streptavidin Mutants*, Australia Patent No. AU 5917796, granted 03/27/97

Smith, C.L., Pandori, M.W., Sano, T., Vajda, S., Cantor, C.R., and Reznik, G.O.: *Streptavidin Mutants*, Canadian Patent No. CA 2222035, granted 03/27/97

Cantor, C.R., Smits, J.G., and Smith, C.L.: *Piezoelectric Force Sensing Apparatus and Methods for Biopolymer Sequencing*, Australia Patent No. AU 7016896 A1, granted 05/09/97

Cantor, C.R.: *Methods of Preparing Probe Array by Hybridization*, US Patent No. US 5,631,134, granted 05/20/97

Sano, T., Cantor, C.R., and Smith, C.L.: *Immuno-Polymerase Chain Reaction System for Antigen Detection*, US Patent No. US 5,665,539, granted 09/09/97

Szafranski, P., Mello, C.M., Sano, T., Marx, K.A., Cantor, C.R., Kaplan, D.L., and Smith, C.L.: *Biotin-Binding Containment Systems*, US Patent No. US 5,679,533, granted 10/21/97

Szafranski, P., Mello, C.M., Sano, T., Marx, K.A., Cantor, C.R., Kaplan, D.L., and Smith, C.L.: *Biotin-Binding Containment Systems*, US Patent No. US 5,681,745, granted 10/28/97

Edwards, C.A., Fry, K.E., Cantor, C.R., and Andrews, B.M.: *Method of Ordering Sequence Binding Preferences of a DNA-Binding Molecule*, US Patent No. US 5,693,463, granted 12/02/97

Cantor, C.R., Chuck, R.S., and Tse, D.B.: *Design and Synthesis of Bispecific DNA-Antibody Conjugates*, US patent No. US 5,635,602, granted 06/03/97

Edwards, C.A., Fry, K.E., Cantor, C.R., and Andrews, B.M.: *Method of Constructing Sequence-Specific DNA-Binding Molecules*, US Patent No. US 5,716,780, granted 02/10/98

Andrews, B.M., Edwards, C., and Cantor, C.R.: *Method for Inhibiting the Binding of a DNA-binding Protein to Duplex DNA*, European Patent No. EP 0823486, granted 02/11/98

Edwards, C.A., Cantor, C.R., Andrews, B.M. and Turin, L.M.: *Screening Assay for the Detection of DNA-Binding Molecules*, US Patent No. US 5,726,014, granted 03/10/98

Edwards, C.A., Fry, K.E., Cantor, C.R., and Andrews, B.M.: *Sequence-Directed DNA-Binding Molecules Compositions and Methods*, US Patent No. US 5,738,990, granted 04/14/98

Edwards, C.A., Cantor, C.R., and Andrews, B.M.: *Screening Assay for the Detection of DNA-Binding Molecules*, Australian Patent No. AU 655839 B2, granted 04/22/98

Edwards, C.A., Cantor, C.R., and Andrews, B.M.: *Screening Assay for the Detection of DNA-Binding Molecules*, European Patent No. EP 0593618, granted 04/22/98

Edwards, C.A., Cantor, C.R., and Andrews, B.M.: *Screening Assay for the Detection of DNA-Binding Molecules*, Austrian Euro Patent No. EP(AT) 0593618, granted 04/22/98

Edwards, C.A., Cantor, C.R., and Andrews, B.M.: *Screening Assay for the Detection of DNA-Binding Molecules,* German Euro Patent No. EP(DE) 0593618, granted 04/22/98

Edwards, C.A., Cantor, C.R., and Andrews, B.M.: *Screening Assay for the Detection of DNA-Binding Molecules,* Denmark Euro Patent No. EP(DK) 0593618, granted 04/22/98

Edwards, C.A., Cantor, C.R., and Andrews, B.M.: *Screening Assay for the Detection of DNA-Binding Molecules,* Spain Euro Patent No. EP(ES) 0593618, granted 04/22/98

Edwards, C.A., Cantor, C.R., and Andrews, B.M.: *Screening Assay for the Detection of DNA-Binding Molecules,* South Korea Patent No. KR 0235575 B1, granted 04/22/98

Edwards, C.A., Fry, K.E., Cantor, C.R., and Andrews, B.M.: *Sequence-Directed DNA-Binding Molecules Compositions and Methods,* US Patent No. US 5,744,131, granted 04/28/98

O'Donnell, M.J., Cantor, C.R., Little, D.P., and Köster, H.: *High Density Immobilization of Nucleic Acid Molecules,* European Patent No. EP0937096, granted 05/14/98

Smith, C.L., Yaar, R., Szafranski, P., and Cantor, C.R.: *Nucleic Acid Detection Methods,* US Patent No. US 5,753,439, granted 05/19/98

Cantor, C.R., Przetakiweicz, M., Smith, C.L., and Sano, T.: *Methods for Replicating an Array of Nucleic Acid Probes,* US Patent No. US 5,795,714, granted 08/18/98

Reznik, G.O., Sano, T., Vajda, S., Smith, C.L., and Cantor, C. R.: *Multiflavor Streptavidin,* European Patent No. EP 0977770, granted 09/17/98

Reznik, G.L., Sano, T., Vajda, S., Smith, C.L., and Cantor, C.R.: *Multiflavor Streptavidin,* Japan Patent No. JP 2001514524, granted 09/17/98

Reznik, G.L., Sano, T., Vajda, S., Smith, C.L., and Cantor, C.R.: *Multiflavor Streptavidin,* Australia Patent No. AU 6701498, granted 09/17/98

Cantor, C.R., Chuck, R.S., and Tse, D.B.: *Design and Synthesis of Bispecific Reagents: Use of Double-Stranded DNAs as Chemically and Spatially Defined Cross-Linkers,* US Patent No. US 5,849,878, granted 12/15/98

Sabanayagam, C.R., Cantor, C.R., and Smith, C.L.: *High Density Streptavidin Supports,* Australia Patent No. AU 8267998 A1, granted 12/30/98

Edwards, C.A., Cantor, C.R., Andrews, B.M., Turin, L.M., and Fry, K.E.: *Method of Determining DNA Sequence Preference of a DNA-Binding Molecule,* US Patent No. US 5,869,241, granted 02/09/99

Cantor, C.R. and Siddiqi, F.: *Inference Sequencing by Hybridization,* Australia Patent No. AU 1118599 A1, granted 05/06/99

Lough, D.M., Kang, C., Kim, Y.T., Kwon, Y.S., Little, M.J., Xiang, G., Cantor, C.R., Koester, H., and Little, D.P.: *Mass Spectrometric Methods for Sequencing Nucleic Acids,* European Patent No. EP 1038031, granted 06/24/99

Lough, D.M., Kang, C., Kim, Y.T., Kwon, Y.S., Little, M.J., Xiang, G., Cantor, C.R., Koester, H., and Little, D.P.: *Mass Spectrometric Methods for Sequencing Nucleic Acids,* Australia Patent No. AU 745149 and AU 1918799, granted 06/24/99

Lough, D.M., Kang, C., Kim, Y.T., Kwon, Y.S., Little, M.J., Xiang, G., Cantor, C.R., Koester, H., and Little, D.P.: *Mass Spectrometric Methods for Sequencing Nucleic Acids,* Canadian Patent No. CA 2314906, granted 06/24/99

Lough, D.M., Kang, C., Kim, Y.T., Kwon, Y.S., Little, M.J., Xiang, G., Cantor, C.R., Koester, H., and Little, D.P.: *Mass Spectrometric Methods for Sequencing Nucleic Acids,* Japanese Patent No. JP 2002508192T and JP 3331210B2, granted 06/24/99

Lough, D.M., Kang, C., Kim, Y.T., Kwon, Y.S., Little, M.J., Xiang, G., Cantor, C.R., Koester, H., and Little, D.P.: *Mass Spectrometric methods for Sequencing Nucleic Acids,* South Korean Patent No. KR-2001033130, granted 06/24/99

Smith, C.L., Yaar, R., Szafranski, P., and Cantor, C.R.: *Nucleic Acid Detection Methods*, European Patent No. EP 0837551, granted 08/11/99

Smith, C.L., Yaar, R., Szafranski, P., and Cantor, C.R.: *Nucleic Acid Detection Methods*, German Euro Patent No. EP(DE) 0837551, granted 08/11/99

Smith, C.L., Yaar, R., Szafranski, P., and Cantor, C.R.: *Nucleic Acid Detection Methods*, Austrian Euro Patent No. EP(AT) 0837551, granted 08/11/99

Szafranski, P., Mello, C., Sano, T., Smith, C.L., Kaplan, D.L., and Cantor, C.R.: *Compositions and Methods for Controlling Genetically Engineered Organisms*, Australia Patent No. AU 2593299 A1, granted 08/12/99

Cantor, C.R., Niemeyer, C.M., Smith, C.L., Sano, T., Hnatowich, D.J., and Rusckowski, M.: *Self-Assembling Multimeric Nucleic Acid Constructs*, US Patent No. US 5,965,133, granted 10/12/99

Cantor, C.R., Przetakiewicz, M., Sano, T, and Smith, C.L.: *Positional Sequencing by Hybridization,* US Patent No. US 6007987, granted 12/28/99

Edwards, C.A., Cantor, C.R., Andrews, B.M., Turin, L.M., and Fry, K.E.: *Sequence-Directed DNA Binding Molecules Compositions and Methods*, US Patent No. US 6,010,849, granted 01/04/00

Sano, T., Cantor, C.R., Vajda, S., Reznik, G.O., Smith, C.L., and Pandori, M.W.: *Streptavidin Mutants*, US Patent No. US 6,022,951, granted 02/08/00

O'Donnell, M.J., Cantor, C.R., Little, D.P., and Köster, H.: *High Density Immobilization of Nucleic Acid Molecules*, German Utility Model Patent No. DE 29724251.2, granted 08/17/00

O'Donnell, M.J., Cantor, C.R., Little, D.P., and Köster, H.: *High Density Immobilization of Nucleic Acid Molecules*, German Utility Model Patent No. DE 29724252.0, granted 08/17/00

Szafrasnki, P., Mello, C., Sano, T., Smith, C.L., Kaplan, D.L., and Cantor, C.R.: *Compositions and Methods for Controlling Genetically Engineered Organisms*, US Patent No. US 6,124,129, granted 09/26/00, withdrawn from issue

O'Donnell, M.J., Cantor, C.R., Little, D.P., and Köster, H.: *High Density Immobilization of Nucleic Acid Molecules*, German Utility Model Patent No. DE 29724250.4, granted 10/19/00

O'Donnell, M.J., Cantor, C.R., Little, D.P., and Köster, H.: *High Density Immobilization of Nucleic Acid Molecules*, German Utility Model Patent No. DE 29724341.1, granted 11/16/00

Cantor, C.R. and Sano, T.: *Methods for the Use of Reduced Affinity Streptavidin*, US Patent No. US 6,207,390, granted 03/27/01

Becker, T., Köster, H., and Cantor, C.R.: *Systems and Methods for Performing Reactions in an Unsealed Environment*, US Patent No. US 6,225,061, granted 05/01/01

Kang, C., Kwon, Y.S., Kim, Y.T., Köster, H., Little, D.P., Little, M.J., Xiang, G., Lough, D.M., and Cantor, C.R.: *Mass Spectrometric Methods for Sequencing Nucleic Acids*, US Patent No. US 6,268,131, granted 07/31/01

Cantor, C.R., Przetakiewicz, M., Smith, C.L., and Sano, T.: *Positional Sequencing by Hybridization*, German Euro Patent No. DE P69330608.4, granted 08/16/01

Cantor, C.R., Przetakiewicz, M., Smith, C.L., and Sano, T.: *Positional Sequencing by Hybridization*, European Patent No. EP 0668932, granted 08/16/01

Cantor, C.R., Przetakiewicz, M., Smith, C.L., and Sano, T.: *Positional Sequencing by Hybridization*, France Euro Patent No. EP(FR) 0668932, granted 08/16/01

Cantor, C.R., Przetakiewicz, M., Smith, C.L., and Sano, T.: *Positional Sequencing by Hybridization*, Great Britain Euro Patent No. EP(GB) 0668932, granted 08/16/01

Przetakiewicz, M., Smith, C.L., Sano, T., and Cantor, C.R.: *Method for Replicating an Array of Nucleic Acid Probes*, German Euro Patent No. EP(DE) 69330608D , granted 08/16/01

Sabanayagam, C.R., Sano, T., Misasi, J., Hatch, A., and Cantor, C.R.: *Nucleic Acid Arrays and Methods of Synthesis*, US Patent No. US 6,284,497, granted 09/04/01

Szafrasnki, P., Mello, C., Sano, T., Smith, C.L., Kaplan, D.L., and Cantor, C.R.: *Compositions and Methods for Controlling Genetically Engineered Organisms*, US Patent No. US 6,287,844, granted 09/11/01

Aslan, F.M., Sano, T., Vajda, S., and Cantor, C.R.: *Dimeric Streptavidins*, Australia Patent No. AU 7359401, granted 12/20/01

Siddiqi, F.A. and Cantor, C.R.: *Use of Nucleotide Analogs in the Analysis of Oligonucleotide Mixtures and in Highly Multiplexed Nucleic Acid Sequencing*, Australia Patent No. AU 6846801, granted 12/20/01

Reznik, G.L., Sano, T., Vajda, S., Smith, C.L., and Cantor, C.R.: *Multiflavor Streptavidin*, US Patent No. US 6,368,813, granted 04/09/02

Edwards, C.A., Cantor, C.R., Andrews, B.M., Turin, L.M., and Fry, K.E.: *Sequencing Directed DNA Binding Molecules Compositions and Methods*, US Patent No. US 6,384,208, granted 05/07/02

Sano, T., Glazer, A.N., and Cantor, C.R.: *Recombinant Streptavidin-metallothionein Chimeric Protein Having Biological Recognition Specificity*, US Patent No. US 6,391,590, granted 05/21/02

O'Donnell, M.J., Cantor, C.R., Little, D.P., and Köster, H.: *High Density Immobilization of Nucleic Acid Molecules*, Australian Patent No. AU 745624, granted 06/11/02

Kang, C., Kwon, Y.S., Kim, Y.T., Köster, H., Little, D.P., Little, M.J., Xiang, G., Lough, D.M., and Cantor, C.R.: *Mass Spectrometric Methods for Sequencing Nucleic Acids*, Australian Patent No. 745149, granted 06/27/02

Fu, D.J., Cantor, C.R., Köster, H., and Smith, C.L.: *Solid Phase Sequencing of Double-Stranded Nucleic Acids*, US Patent No. US 6,436,635, granted 08/20/02

Becker, T., Köster, H., and Cantor, C.R.: *Systems and Methods for Performing Reactions in an Unsealed Environment*, US Patent No. US 6,485,913, granted 11/26/02

Przetakiewicz, M., Smith, C.L., Sano, T., and Cantor, C.R.: *Method for Replicating an Array of Nucleic Acid Probes*, Japanese Patent No. JP03793570B2, filed 11/045/93, granted 7/5/06

Kang, C., Kwon, Y.S., Kim, Y.T., Köster, H., Little, D.P., Little, M.J., Xiang, G., Lough, D.M., and Cantor, C.R.: *Mass Spectrometric Methods for Sequencing Nucleic Acids*, European Patent No. EP1038031B1, granted 11/26/03

Niemeyer, C. M., Sano, T., and Cantor, C. R.: *Supramolecular Bioconjugates,* Application filed: September 20, 1995, US Patent granted

Cantor, C.R., and Siddiqi: *Use of Nucleotide Analogs in the Analysis of Oligonucleotide Mixtures and in Highly Multiplexed Nucleic Acid Sequencing*, US Patent No. US6,660,229, granted 12/09/03

O'Donnell, M.J., Cantor, C.R., Little, D.P., and Köster, H.: *High Density Immobilization of Nucleic Acid Molecules*, US Patent No. US6,818,394, granted 11/16/04

Edwards, C.A., Cantor, C.R., Andrews, B.M., Turin, L.M., and Fry, K.E.: *Sequence-directed DNA Binding Molecules Compositions and Methods*, US Patent No. US6,869,765, granted 03/22/05

Fu, D-J, Cantor, C.R., Hoster, H., Smith, C.L.: *Solid phase sequencing of double-stranded nucleic acids*, US 6,991,903, granted 1/31/06

Cantor, C.R., Broude, N.E., Witte-Hoffmann, C.: *Nucleic acid supported protein complementation*, U.S. 7,662,554, granted 2/16/10

Lo, Y-M.D., Chui, R.W.K., Tsui, B.Y., Ding, C., Cantor, C.: *Method for the detection of chromosomal aneuploidies*, U.S. 7,645,576, granted 1/12/10

Sano, T., Glazer, A., Cantor, C.R.: Streptavidin proteins, US 7,179,618, granted 2/20/07

Little, D.P., O-Donnell-Maloney, M.J., Cantor, C.R., Koster, H.: *Systems and methods for preparing and analyzing low volume analyte array elements*, US 7,232,688, granted 6/19/07

Little, D.P., O-Donnell-Maloney, M.J., Cantor, C.R., Koster, H.: *Systems and methods for preparing and analyzing low volume analyte array elements*, US 7,285,422, granted 10/23/07

Cantor, C.R., Ding, C.: *Methods for prenatal diagnosis of chromosomal abnormalities*, U.S. 7,655,399, granted 2/2/10

Cantor, C.R., Ding, C.: *Haplotype analysis*, U.S. 20070122805, allowed 12/10/09

Collins, J.J., Isaacs, F.J., Cantor, C.R., Dwyer, D.J.: *Cis/trans riboregulators*, U.S. 20070136827, published 6/14/07

Cantor, C.R., Ding, C., Lo, Y.M.D., Chiu, R.W.K.: *Method for non-invasive prenatal diagnosis*, U.S. 20070207466, published 9/6/07

Little, D.P., O'Donnell-Maloney, M.J., Cantor, C.R., Koster, H.: *Matrix-assisted laser desorption ionization mass spectrometry substrates having low volume matrix array elements*, U.S. 20080008874, published 1/10/08

Cantor, C.R., Prezetakiewiczr, M., Smith. C.L., Sano, T.: *Arrays of probes for positioning sequencing by hybridization*, U.S 7,319,003, granted 1/15/08

Cantor, C.R., Ding, C.: *Method for Detecting and Quantifying Rare Mutations/Polymorphisms*, U.S. 20080032287, published 2/7/08

Braun, A., Cantor, C.R., Kammerer, S.M., Taylor, S., Burns-Hamuro, L., Cook, C., Olson, G., Self, C.: *Kinase anchor protein muteins, peptides thereof and related documents*, US 7,432,342, granted 10/7/08

Cantor, C.R., Siddiqi, F.A.: *Method for De Novo Detection of Sequences of Nucleic Acids: Target Sequencing by Fragmentation,* U.S. 7,470,517, granted 12/30/08

Cantor, C.R., *Single molecule nucleic acid sequence analysis processes and compositions,* US20090202984A1, publication date 08/13/09

Broude, N.E., Cantor, C.R., Burton, M.A., Demidov, V.V.: *Real time nucleic acid detection in vivo using protein complementation,* US20090029370A1, Publication date 1/29/09

Cantor, C.R., Siddiqi, F.A.: *Method for de novo detection of sequences in nucleic acids: target sequencing by fragmentation,* US20090075288 A1, publication date 03/19/2009

Braun, A., Cantor, C.R., Kammerer, S.M., Taylor, S., Burns-Hamuro, L., Cook, C., Olson, G., Self, C.: *Kinase anchor protein muteins, peptides thereof and related methods*, US20090155846, publication date 06/18/2009

Niemeyer, C.M., Cantor, C.R., Sano, T., and Smith, C.L.: *Nucleic acid directed immobilization arrays and methods of assembly*, US Patent No. US 7,569,341, granted 08/04/09

Broude, N., Cantor, C.R., Demidov, V.V.: *Activated split-polypeptides and methods for their production and use,* US Patent US2009 0220942, Publication date 09/03/09

Cantor, C.R., Zhang, L., Kasif, S.: *Quantification of nucleic acids and proteins using oligonucleotide mass tags,* US Patent US 2009 0305237, Publication date 12/10/09